REMARKS

Responsive to the outstanding Office Action, applicant has carefully studied the Examiner's rejections and the comments relative thereto. Favorable reconsideration of the application is respectfully requested in light of the following detailed arguments.

After amendment, claims 30-39 are pending in this application. In this response, claims 30-31 and 35-39 have been amended, have been canceled. No new matter has been introduced by these amendments.

REJECTIONS UNDER 35 USC §112 First Paragraph

Claims 30-39 were rejected under 35 USC §112, first paragraph, for failing to comply with the enablement requirement. The Examiner notes that the phrase "operating at quench pressure" fails to establish a sufficient relationship between the glass material and the method of processing steps to be considered enabling for one of ordinary skill. The Examiner similarly rejects the reference to "quench pressure". The Examiner further rejects claim 30 stating that there is no supporting basis for applicants recited limitation wherein the tempering operation is carried out under such conditions as required to achieve ANSI z26 standards in the application as originally filed.

In response thereto, the phrase "the method including the steps of heating the glass in a furnace and subsequently quenching the glass with air from upper and lower quench nozzles in a quench" has been added to claims 30 and 35 to 38. Basis for this amendment can be found, at least, in Examples 1-6.

This amendment provides sufficient structural detail (based on the teaching in the Examples) as to the equipment required in order to perform the method claimed in the claims. One skilled in the art would have already known that tempering glass involves heat it (typically in a furnace) and subsequently quickly cooling it (in some kind of quench apparatus), however, the claims now explicitly state that the glass is heated in a furnace and subsequently cooled ("quenched") using cooling, pressurized quench air from quench nozzles in a quench box.

The claims have also been amended to show a quench pressure of 17/16 kPa (upper/lower quench nozzles) for the pressure required to temper a glazing of standard

composition. Support for this can be found, at least, lines 15-21 of paragraph [0047] in the published application. It is believe that this defines the term "quench pressure" used in the claims. Although the relative percentage pressure term for the glass of the invention is still present, it can now be calculated against an actual pressure for the comparative "standard composition" glass.

With regard to the Examiner's rejections regarding standards, claims 30, 31, 38 and 39 now refer to current toughening standard ANSI Z26.1-1996 which is the American National Standard for Safety Glazing Materials for Glazing Motor Vehicles and Motor Vehicle Equipment Operating on Land Highways. It should be noted that paragraph [0036] defines "the required standards" as the standards required by the authorities in the country in which the glazing is to be used, which is ANSI Z26.I-1996 for the USA. It should be noted that this standard is readily available and known to one skilled in the art.

The claims as filed referred to tempering glass to "the required standards". Lines 14-19 of paragraph [0036] include a definition of "required standards" as meaning the standards required by the authorities in the country in which the glazing is to be used. In Europe, this is generally ECE R43 for automotive glazings. In the USA this is ANSI Z26.I-1996: this is the current version of the standard *which was also current at the earliest priority date of the present application*. One skilled in the art would recognize this standard, and would also recognize that revisions to this standard are widely known and publicized. The standard clearly shows the publication date, and thus notes dates of revision of the standard. Even if the standard had been changed, one skilled in the art, knowing the priority date of the application, would be able to identify the standards in place at the time. While ANSI Z26.1-1996 is not specifically referenced in the application as filed, it would have been instantly obvious to one skilled in that art that for automotive glazings destined for the US market, this is the applicable standard. As the specification referred to the applicable national standards, it is respectfully submitted that this material is sufficiently disclosed as to be enabling.

The claims have thus been amended herein in a manner believed to comply with the requirements of 35 USC §112, first paragraph. It is therefore requested that this rejection be reconsidered and withdrawn.

REJECTIONS UNDER 35 USC §112 Second Paragraph

Claims 30-39 have also been rejected under 35 USC §112, second paragraph, for omitting required structural relationships. The Examiner stated that referring to a relative measure of a physical state imparts no patentable weight. The Examiner also opined that the term ANSI Z26 is understood to be variable with time, and as such did not particularly define the metes and bounds of the invention.

The Examiner is referred to the above-reference amendments with regard to these rejections. The claims have been amended in such a manner as to include the required structural connections in order to understand the subject matter being claimed. While it is believed that one skilled in the art would recognize that heating typically occurs in a furnace and that the subsequent cooling occurs in a quench, these structural limitations have been added to the claims. As noted above, while there is still a declaration of a relative relationship between conditions, there are also normative values included for "standard composition" glass, which would allow one skilled in the art to understand that the relative percentages can now be calculated against an actual pressure for the comparative "standard composition" glass. The Examiner states that a relative measure is insufficient in the absence of a related apparatus or quantitative value, and these have been provided.

With regard to the ANSI standards, these again have been addressed above. The applicable ANSI standard, which is specifically references in the claims, is the same standard that was in force at the time of the earliest priority date of this application. One skilled in the art would note that the national standards for the specifically identified properties were shown in this ANSI standard (for the United States) and would realize that this was the objective standard at the time of the invention.

In view of the above, reconsideration and withdrawal of the present rejections are respectfully requested.

REJECTIONS UNDER 35 USC §103

Claims 30-39 and 44 were rejected under 35 USC §103 as being unpatentable over Cheng in view of Littleton. Claim 44 has been canceled herein thereby rendering the rejection thereagainst moot.

Before discussing the applied art in detail, applicants would like to point out features of the present invention, as claimed in independent claim 30. Claim 30 shows an improvement in a method of tempering a glazing comprised of boron-free glass having a magnesium oxide content of less than 1% by weight, a coefficient of thermal expansion greater than 95 x 10^{-7} per degree Centigrade and a Fracture Toughness of less than 0.72 $MPam^{1/2}$. The improvement comprises operating a quench at a quench pressure at least 20% less than the quench pressure required to temper a corresponding glazing of standard composition to the standard ANSI Z26.1-1996 under otherwise similar conditions.

The Cheng (WO 01/07356 Al) reference fails to disclose a method of tempering a glazing of boron-free glass having a magnesium oxide content of less than 1% by weight. Cheng addresses glass compositions for infrared and ultraviolet radiation absorbing green glass compositions (page 1, lines 7-8). There is no disclosure of a method of tempering such compositions. Insofar as there is an enabling disclosure of glass compositions in Cheng, on page 9, lines 13-23 and on page 10, lines 24-34 the glass compositions consist essentially of ingredients including about 3 to 4 % by weight of MgO and excluding boron. This concentration of Magnesium oxide is outside the range claimed in the present invention. Further, the specific compositions of examples 11 and 12 (at the bottom of page 16) and the green glass described on page 17, lines 32-27 are also boron-free and include 4.14 %, 3.97 % and 4.00 % MgO respectively. The Examiner specifically notes (and emphasizes) that Cheng includes from 1 to 5% by weight MgO. Claim 30 has been amended herein to indicate a MgO composition of

less than 1%. Support for the amendment can be found in lines 8-10 of paragraph [0022] of the published application.

Littleton (US 2,311,846) does not show a method of tempering a glazing of boron-free glass having a magnesium oxide content of less than 1% by weight. The only compositions described in Littleton are in Table I at the bottom of page 2. Only example F is boron-free but this includes a "standard" amount of magnesium oxide (3.5 %) — the text immediately following the table indeed states that the glass in example F is a typical soda lime glass, which would be recognized by one skilled in the art as containing a higher concentration of MgO than claimed in the present invention.

In response to the Examiner's rejections, it is first submitted that there is no disclosure in Cheng of a method of tempering a glazing of boron-free glass having a magnesium oxide content of less than 1 % by weight. Cheng is concerned with glass compositions for infrared and ultraviolet radiation absorbing green glass compositions page 1, lines 7-8). There is no disclosure of a method of tempering such compositions.

Insofar as there is an enabling disclosure of glass compositions in Cheng, on page 9, lines 13-23 and on page 10, lines 24-34 the glass compositions consist essentially of ingredients including about 3 to 4% by weight of MgO and excluding boron. Furthermore the specific compositions of examples 11 and 12 (at the bottom of page 16) and the green glass described on page 17, lines 32-27 are also boron-free and include 4.14%, 3.97% and 4.00% MgO respectively: much greater than the claimed 1 %.

The Examiner compares Composition I in paragraph [0031] to the compositions disclosed in Cheng to support of his contentions. Composition I comprises 71.0% SiO_2, 10.5% CaO, 1.0% Fe_2O_3, 1.11% Al_2O_3, 0.21% MgO, 14.9% Na_2O, 0.64% K_2O, 0.35% $Ti0_2$, 0.17% SO_3 and exhibits 35% ferrous. Cheng includes four "general" compositions on pages 9 and 10, which have been summarized below (the italicized numbers in square brackets representing the number of possible values for each range for the number of decimal places given):

Weight%	1	2	3	4
SiO_2	65-75 *[11]*	70-73 *[4]*	65-75 *[11]*	70-73 *[4]*
Na_20	10-15*[6]*	12-14*[3]*	10-15*(6)*	12-14 *[3]*
K_20	0-4 *[5]*	0-1 *[2]*	0-4 *[5]*	0-1 *[2]*
MgO	1-5 *[5]*	3-4 *[2]*	1-5 *[5]*	3-4 *[2]*
CaO	5-15 *[11]*	6-l0 *[5]*	5-15 *[11]*	6-10 *[5]*
$A1_2O_3$	0-3 *[4]*	0-2 *[3]*	0-3 *[4]*	0-2 *[3]*
Fe_2O_3	0.51-0.96 *[46]*	0.51-0.96 *[46]*	0.5(0.48)-0.9(0.92) *[41]*	0.5(0.48)-0.9(0.92) *[41]*
FeO	0.15-0.33 *[19]*	0.15-0.33 *[19]*	0.15-0.33 *[19]*	0.15-0.33 *[19]*
CeO_2	0.20-1.40 *[121]*	0.20-1.40 *[121]*	0.10-1.36 *[127]*	0.10-1.36 *[127]*
$Ti0_2$	-	-	0.02-0.85 *[84]*	0.02-0.85 *[84]*
Total Permutations	7,677,740,400	76,142,880	603,333,007,200	5,983,467,840

Only general compositions 3 and 4 of Cheng include titania. However, each of these has a maximum iron content of 0.9 (0.92) % wt, which is significantly lower than the 1.0 % wt defined in Composition 1. Furthermore 0.21% MgO is also significantly lower than the 1% wt of composition 3 and the 3% wt of composition 4.

Regarding the maximum iron content, the Examiner has mistakenly quoted that Fe_2O_3 can be in the range 0.7-1.25% wt. Page 11, lines 10-17 of Cheng explain that 0.7-1.25 % of iron in the **batch** equates to *around 0.51-0.96 %wt of total iron in the glass*. The maximum iron content drops from 0.96 %wt in general compositions 1 and 2 to 0.9 %wt in general compositions 3 and 4. In fact, lines 27-31 on page 9 of Cheng explain that in order to maintain the desired ranges of transmittance, dominant wavelength and color purity when substituting titanium oxide for cerium oxide in the glass, the weight percent of total iron must be reduced. So, the disclosure of Cheng clearly shows that for a titania-containing glass, the maximum iron content is 0.9 %wt.

It is therefore submitted that no comparison to be made between Composition I and any of the glasses disclosed in Cheng, especially as generally described in compositions 1 to 4 summarized above. Furthermore, as shown in the "Total Permutations" row of the table above, there is no way that that one skilled in the art could (or would!) be motivated to try routine experiment with the ranges given to arrive at a glass anywhere close to Composition I. There are, literally, millions of combinations of ingredients to try, so mere trial-and-error would be effectively impossible. Further, because of the differences between the glasses in Cheng and the glasses in the present application, the properties of coefficient of thermal expansion and fracture toughness cannot be said to be inherent in the Cheng glasses. The present invention lies in the creation of a glass which can be tempered by a method that employs lower quench pressures than would be necessary for a glass of standard composition.

Turning to the Littleton reference, it is respectfully submitted that there is no disclosure in Littleton of a method of tempering a glazing of boron-free glass having a magnesium oxide content of less than 1 % by weight and a coefficient of thermal expansion greater than 95 x 10^{-7} per degree Centigrade, and which comprises the steps of heating the glass in a furnace and subsequently quenching the glass with air from upper and lower quench nozzles. The only compositions described in Littleton are in Table I at the bottom of page 2. Only example F is boron-free but this includes a "standard" amount of magnesium oxide (3.5 %) and has a coefficient of thermal expansion of 92 x 10^{-7} per degree Centigrade: in fact, the text immediately following the table indeed states that the glass in example F is a typical soda lime glass.

It is additionally submitted that, as previously argued, Cheng should not be the primary reference because there is no disclosure of a method of tempering a pane of glass, nor of the properties of thermal expansion or fracture toughness for boron-free glass having a magnesium oxide content of less than 1%. Any arguments regarding the inherency of these properties in the glasses of Cheng are flawed.

Turning to Littleton does not provide any assistance in arriving at the invention presently claimed. Littleton does admittedly disclose a method of tempering a pane of

glass, and that *"the degree of temper obtained under specific chilling conditions is controlled primarily by the thermal expansion coefficient of the* glass" (page 1, right-hand column, lines 14-17).

With regard to the additional independent claims, there is no suggestion that boron-free glasses (of which there is only 1 example given, Example F) having a magnesium oxide content of less than 1% (of which there are no examples) which have values of thermal expansion coefficient and fracture toughness as claimed (the latter property not being disclosed at all) could or would be tempered using a quench pressure of:

- at least 20% less than the quench pressure of 17/16 kPa (upper/lower quench nozzles) required to temper a corresponding glazing of standard composition to standard ANSI Z26.l-1996 under otherwise similar conditions (claim 30)
- not more than 12.5 kPa for 3 mm glass (claim 35)
- not more than 10 kPa for 4mn glass (claim 36)
- not more than 6 kPa for 5 mm glass (claim 37)
- at least 10 % less than the quench pressure of 17/16 kPa (upper/lower quench nozzles) required to temper a corresponding glazing of standard composition to standard ANSI Z26.1-1996 under otherwise similar conditions (claim 38).

In fact, there are various tempering methods taught in Littleton, all of which are based around specific chilling conditions (i.e. quench *temperatures).* The paragraph bridging from the bottom of the left hand column to the top of the right hand column on page 1 discusses, subsequent to heating the glass, "subjecting it to a relatively severe chilling ... at a temperature low enough to cause the surface layers of glass to set ... then immediately subjecting the glass to a temperature lying well above the lower temperature for a somewhat longer period of time". There is no teaching or suggestion in Littleton of quench *pressures,* especially of being able to reduce the quench pressure for glasses of certain compositions, as per the amended claims of the present application.

Beginning at line 5 of the right hand column on page 2 of Littleton, we are told that "a wide variety of procedures may be followed to produce square strain patterns.

The glassware may be heated in liquid baths of suitable composition *or* in air so long as the entire article is raised to a temperature near to its softening temperature (there is no specific mention of heating in a furnace, as is now claimed). The initial chill may be effected either by subjecting the article to a spray of finely divided liquid cooling medium *or* by immersing the article momentarily in a liquid bath (there is no mention here of using cooling air to quench the glass). The second chilling of the article may advantageously be performed in a molten salt bath (which is *quite* different from using cooling air from quench nozzles)".

Inspection of Table II on page 3 of Littleton shows that for Example glass F, a mixture of $NaCl/K_2SOilNa_2SO_4$ is used as the heating medium, and for the first and second chilling media a bath of $NaNO_3/KNO_3$ into which the glass is dipped is used.

It is respectfully submitted that one skilled in the art would not be motivated to combine the teachings of Cheng and Littleton. The references belong in completely different technical fields and were it not for knowledge of the present invention, there would be no reason to bring these two documents together

Therefore, it is respectfully submitted that no reasonable combination of the applied references yield the present invention as claimed. Further, even if the references did show all of the features as claimed, it is respectfully submitted that one skilled in the art would have no reason to combine these references.

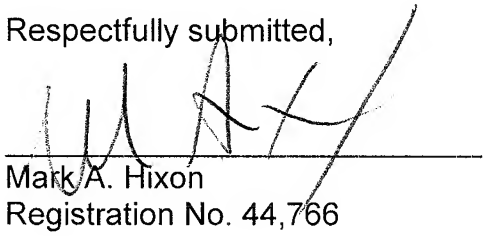
In summary, amended claims 30 to 39 are believed to be non-obvious over both of the applied references Cheng and Littleton and any reasonable combination thereof. In view of the above, reconsideration and withdrawal of the present rejection are respectfully requested.

SUMMARY

For the reasons above, it is submitted that the independent claims are allowable over the applied art of record. The remaining claims are believed to be allowable based, at least, upon their dependence from allowable base claims as shown above.

Should the Examiner wish to modify any of the language of the claims, applicants' attorney suggests a telephone interview in order to expedite the prosecution of the application.

Respectfully submitted,



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